

## DYNAMICALLY TARGETING ONLINE ADVERTISING MESSAGES TO USERS

### CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application No. 60/166,949 filed November 22, 1999, which is hereby incorporated by reference.

### 5 TECHNICAL FIELD

The present invention is directed to Internet advertising techniques.

### BACKGROUND

As computer use, and particularly the use of the World Wide Web, becomes more and more prevalent, the volumes of Internet advertising presented grow larger and larger. While online advertising messages are in some cases quite effective, their overall level of effectiveness is limited by the arbitrariness with which specific advertising messages are selected for presentation to particular users--in general, advertising messages are presented to users without regard for their identities or other information available about them.

Additionally, conventional online advertising techniques fail to use effective testing and control methodologies to evaluate the effectiveness of presented advertising messages.

Accordingly, a facility for analyzing the effectiveness of online advertising and dynamically targeting online advertising messages to users would have significant utility.

### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a high-level block diagram showing the environment in which the facility preferably operates.

Figure 2 is a targeting diagram showing a targeting program that utilizes one test group, one segment, and one treatment.

Figure 3 is a targeting diagram showing a targeting program for one test group, two segments, and one treatment.

Figure 4 is a targeting diagram showing a targeting program having two test groups, two segments, and one treatment.

Figure 5 is a targeting diagram for a targeting program having two test groups, two segments, and two treatments.

## DETAILED DESCRIPTION

A software facility for analyzing the effectiveness of online advertising and dynamically targeting online advertising messages to users based on the results of the analysis is provided. The facility assigns user identifiers, called "cookies," to users that are to participate in the analysis. The facility divides these cookies into test groups, each of which is subjected to a different sequence of conditions. A percentage of the cookie population is specified for each test group. When an advertising request is received from a user identified by the user's cookie, the facility determines which test group the cookie is in, and evaluates the condition sequence for that test group in order to select an advertising message to send to the user in response to the advertising request.

Associated with each condition is a treatment, such as a single advertising message to serve, or a group of advertising messages from which to serve one advertising message. Some conditions can have multiple treatments--in this case, the test group for the column is subdivided into treatment subgroups each corresponding to one of the treatments. A percentage of the testing group population is specified for each of the treatment subgroups to receive the corresponding treatment when those cookies satisfy the associated condition. A condition, its treatment subgroups, and their treatments are known as a "segment." The set of the treatment subgroups that a particular user is in, together with the test group that the cookie is in, is known as that user's "cookie migration path." The number of different cookie migration paths in a single test group is the product of the number of treatment subgroups for each segment.

When an advertising message request is received from a user, the facility uses the user's cookie to select the test group of which the user is a member. The conditions of the condition sequence for the selected test group are then evaluated for the

user, in order, to identify the first condition in the sequence that is satisfied. If no conditions in the sequence are satisfied, the facility identifies a default condition. If the identified condition has a single treatment, it is used to serve an advertising message to the user. If the identified condition has a multiple treatments, the user's cookie is used to select the treatment subgroup of which the user is a member, and the treatment for the selected treatment subgroup is used to serve an advertising message to the user. Effectiveness data for a particular served advertising message--such as conversion/no conversion, transaction value, etc.--is stored in conjunction with the cookie migration e user to whom it was served. Effectiveness data stored in this manner can be analyzed, or "rolled up," in a variety of ways, including aggregating the data for cookie migration paths containing each of the treatments in a particular segment.

hwh?   
 15 12 60  
 20  
 The facility integrates a variety of variables when making its advertising message presentation decision. These variables include click-stream data indicating the sequence of links that the user has traversed, and client transaction data indicating transactions that the user has entered into, such as purchase transactions; real-time data indicating current actions of the user, such as the current page being viewed by the user, and historical data indicating past actions of the user, such as web pages visited by the user, and advertising messages presented to the user; and user data pertaining specifically to the user and global data pertaining to larger groups of users, or that is user-independent. The integration of these different types of data is a departure from conventional customer targeting techniques.

25 The facility performs randomization and controlled testing. The facility randomizes the universe of cookies into different test groups. Those assignments are maintained for as long as desired, ensuring independence of test group assignment across all clients. Even cookies that have not been profiled--that is, those for which the facility has no historical data--are randomized the first time they are seen. This aspect of the facility differs from conventional online advertising techniques which are typically unable to discern all of the advertising messages in a campaign seen by a particular viewer.

30 Traditional direct marketing techniques require up-front segmentation of users. Marketers typically mail certain messages to the various segments, evaluate the results, and then re-segment. The facility is more dynamic. It may have the opportunity

to message to the same user on behalf of an advertiser several times. By taking into account recent behavior into an advertising message decision, the facility makes an informed choice. The facility updates users' segmentation throughout campaigns. However, when evaluating the most effective advertising message within a segment it is important that the populations receiving each treatment (advertising message) are identical in their treatment while they were in other segments as well. The populations receiving treatments within one segment are equally filled with all the possible combinations of historical handling.

Because a user's segmentation changes throughout a campaign, the advertising messages seen while in previous segments affect the performance metrics of advertising messages seen while in the current segment. By attributing conversions and other effectiveness measures to groups of cookies having the same cookie migration path and seeing the same advertising messages under the same conditions rather than attributing effectiveness measures to particular advertising messages, the facility takes into account the variance caused by messages in other segments into account while evaluating messages within a segment in an unbiased and low variance manner.

Figure 1 is a high-level block diagram showing the environment in which the facility preferably operates. The diagram shows a number of client computer systems 111-112. An Internet user preferably uses one such client computer system to connect, via the Internet 100, to an Internet publisher computer system, such as Internet publisher computer systems 130 and 140, to retrieve and display a Web page.

In cases where an Internet advertiser, through the Internet advertising service, has purchased advertising space on the Web page provided to the Internet user computer system by the Internet publisher computer system, the Web page contains a reference to a URL in the domain of the Internet advertising service computer system 120. When a user computer system receives a Web page that contains such a reference, the Internet user computer systems sends a request to the Internet advertising service computer system to return data comprising an advertising message, such as a banner advertising message. When the Internet advertising service computer system receives such a request, it selects an advertising message to transmit to the Internet user computer system in response the request, and either itself transmits the selected advertising message or redirects the request containing an identification of the selected advertising message to

an Internet content distributor computer system, such as Internet content distributor computer systems 170 and 180. When the Internet user computer system receives the selected advertising message, the Internet user computer system displays it within the Web page.

5 The displayed advertising message preferably includes one or more links to Web pages of the Internet advertiser's Web site. When the Internet user selects one of these links in the advertising message, the Internet user computer system dereferences the link to retrieve the Web page from the appropriate Internet advertiser computer system, such as Internet advertiser computer system 150 or 160. In visiting the Internet  
10 advertiser's Web site, the Internet user may traverse several pages, and may take such actions as purchasing an item or bidding in an auction. Revenue from such actions typically finances, and is often the motivation for, the Internet advertiser's Internet advertising.

The Internet advertising service computer system 120 preferably includes one or more central processing units (CPUs) 121 for executing computer programs such as the facility; a computer memory 122 for storing programs and data; a persistent storage device 123; and a computer-readable media drive 124, such as a CD-ROM drive, for reading programs and data stored on a computer-readable medium.

While preferred embodiments are described in terms of the environment described above, those skilled in the art will appreciate that the facility may be implemented in a variety of other environments, including a single, monolithic computer system, as well as various other combinations of computer systems or similar devices.

To more fully illustrate its implementation and operation, the facility is described in conjunction with several examples. Figures 2-5 are targeting diagrams  
25 showing targeting examples.

Figure 2 is a targeting diagram showing a targeting program that utilizes one test group, one segment, and one treatment. Because this targeting program includes just one test group, all cookies flow from the cookie source to column 220 representing the condition sequence for the single test group. The cookies are each subjected to the condition "Drop Off at the Order Page?" That is, the facility determines from profile data  
30 whether the user associated with the current cookie visited an order page of a web merchant web site, but then failed to continue in the ordering process by advancing to the

next page in the ordering process. Those cookies that satisfy this condition proceed to the "Drop-Off" segment, where they are presented with advertising message 231 that is appropriate for users in this segment. Because this condition is the last condition in the condition sequence, those cookies that do not satisfy this condition proceed to the default segment, where they are presented with advertising message 241. While Figure 3 shows each advertising treatment as a banner advertisement, the facility may employ advertising treatments and messages of various different types, also including audio advertising messages, paper-based advertising messages, video advertising messages, and computer programs or similar agents for delivering advertising messages.

Figure 3 is a targeting diagram showing a targeting program for one test group, two segments, and one treatment. All the cookies are directed to column 320, representing the only test group. Those cookies that satisfy condition 330 are part of the "Drop-Off" segment, and are presented with advertising message 231. Those cookies that do not satisfy condition 330 but satisfy condition 340 are part of the "Cross-Sell" segment, and are presented with advertising message 341. Those cookies that satisfy neither condition are part of a default segment, and are presented with advertising message 351.

Figure 4 is a targeting diagram showing a targeting program having two test groups, two segments, and one treatment. The targeting program has two test groups, represented by columns 421 and 422. Fifty percent of the cookies flow from the cookie source to the test group represented by column 421, and the other fifty percent of the cookies flow to the test group represented by column 422. In column 421, all cookies in the first test group are subjected to condition 430. Those that satisfy it are in the "Cross-Sell" segment and are presented with advertising message 431, while those that do not satisfy condition 430 proceed to condition 440. Those cookies that satisfy condition 440 are part of the "Drop-Off" segment, and are presented advertising message 441. Those cookies in the first test group that fail both conditions 430 and 440 are in the default segment, and are presented with advertising message 471. Cookies among the second test group are subjected to the conditions 450 and 460 in column 422 in the order shown, and are segmented based upon those conditions.

While the number of segments for each test group in the program shown in Figure 4 are the same, each test group may have any number of segments and associated

conditions. Likewise, segments used for one test group need not be used for other test groups. Further, where the same segment is used for more than one test group, a different advertising message may be presented to cookies that fall into that segment in the first test group than is presented to cookies that fall into that segment in the second test group.

Figure 5 is a targeting diagram for a targeting program having two test groups, two segments, and two treatments. This testing program is similar to the one shown in Figure 4, except that it provides multiple treatments for each segment. This is illustrated by the "Cross-Sell" segment for the first test group. Cookies in the first test group that are directed to column 521 and satisfy test 530 are split into two groups, called treatment subgroups. A first treatment subgroup of cookies, constituting 75% of the cookies in test group 1, are subjected to a first treatment and presented with advertising message 531. A second treatment subgroup of these cookies constituting 25% of the cookies in the first test group are subjected to a second treatment, and presented with advertising message 532. Other segments for both test groups are each similarly split into two treatments. While the number of treatments shown for each segment in Figure 5 is the same, each segment may have any number of conditions.

In the example shown in Figure 5 (having two segments, two test groups, and two treatments), there are really 16 unique random populations, shown below in Table 1.

Test Group	Segment 1 Treatment	Segment 2 Treatment	Segment 3 Treatm	Fraction of Whole
1	1 Scanners	10% off	Computer Store	0.046875
2	1 Scanners	10% off	Software Store	0.140625
3	1 Scanners	15% off	Computer Store	0.046875
4	1 Scanners	15% off	Software Store	0.140625
5	1 Printers	10% off	Computer Store	0.015625
6	1 Printers	10% off	Software Store	0.046875
7	1 Printers	15% off	Computer Store	0.015625
8	1 Printers	15% off	Software Store	0.046875
9	2 10% off	Scanners	Computer Store	0.046875
10	2 10% off	Scanners	Software Store	0.140625
11	2 10% off	Printers	Computer Store	0.015625
12	2 10% off	Printers	Software Store	0.046875
13	2 15% off	Scanners	Computer Store	0.046875
14	2 15% off	Scanners	Software Store	0.140625
15	2 15% off	Printers	Computer Store	0.015625
16	2 15% off	Printers	Software Store	0.046875

Table 1

To measure which strategy, *i.e.*, which column of the targeting program, performed best, we aggregate all the data for each test group. For the first test group, this

means combining the data from rows 1–8 in the above table. The main metrics for the test groups in the example are shown below in Table 2.

Name	Impressions	Clicks	Purchases	Registrations
Test Group 1	102079	612	87	148
Test Group 2	103444	517	72	133

Table 2

The facility need not attribute a purchase or registration to a single advertising message. Since cookies can only be assigned to one test group, the facility attributes credits for the conversion to the test group. This facilitates accurate comparison of the different strategies without having to rely on an arbitrary algorithm to assign an action to a specific advertising message.

For treatment comparison, the facility uses a similar framework. To start, the facility aggregates all of the results for users that were assigned to a certain treatment within a segment. For example, to measure the performance of the “10% banner” in the second segment of the first test group, the facility begins by combining all the unique populations that have the “10% banner” assigned. Rows 1, 2, 5, and 6 in Table 1 above are therefore combined. However, for treatment comparison, the facility need not include all the users from rows 1, 2, 5, and 6. We include only those users that saw at least one advertising message while in that segment. It is clear that the actions of users that have not seen an advertising message in that segment – because either they were never in the segment or were not shown an advertising message while in it – cannot be due to what treatment they were assigned to, so they are excluded. Therefore, the number of impressions used in our metrics for a subgroup is always between the “group impressions” (advertising messages shown to users while they are in that segment) and the total impressions received by all cookies that have been assigned to that treatment. Using the percentages from the example shown in Figure 5, the treatment comparison metrics are shown below in Table 3.



Type	Test Group	Segment Name	Treatment	Impressions	Group Impressions	Clicks	Group Clicks	Purchases	Registrations
Subgroup	Test Group 1	Cross-sell	Scanners	9974	7672	60	46	11	16
Subgroup	Test Group 1	Cross-sell	Printers	3297	2536	20	15	3	5
Subgroup	Test Group 1	Drop-off	10% off	12634	10107	76	61	11	18
Subgroup	Test Group 1	Drop-off	15% off	12886	10309	77	62	13	21
Subgroup	Test Group 1	Default	Computer Store	21697	18081	130	108	20	33
Subgroup	Test Group 1	Default	Software Store	68319	53374	410	320	58	99
Subgroup	Test Group 2	Drop-off	10% off	14468	11859	72	59	10	19
Subgroup	Test Group 2	Drop-off	15% off	14439	11933	72	60	11	20
Subgroup	Test Group 2	Cross-sell	Scanners	7227	5434	36	27	6	10
Subgroup	Test Group 2	Cross-sell	Printers	2331	1807	12	9	2	3
Subgroup	Test Group 2	Default	Computer Store	20728	18024	104	90	14	27
Subgroup	Test Group 2	Default	Software Store	64177	54387	321	272	46	84

Table 3

In Table 3, the column headings mean the following:

**Treatment:** the advertising message or rotation of advertising messages we are testing.

**Impressions:** the total impressions viewed by users who saw at least one advertising message while in the subgroup.

**Group impressions:** the total impressions shown to users while in that subgroup.

**Clicks:** the total clicks from users who viewed at least one advertising message while in that subgroup.

**Group clicks:** the total clicks from users while in the subgroup.

**Purchases:** the totals purchases from users who saw at least one advertising message in the subgroup before purchasing.

**Registrations:** the total registrations from users who saw at least one advertising message in the subgroup before purchasing.

Table 3 can be viewed in conjunction with Table 2 showing test group performance. For example, in Table 3, the sum of the "group clicks" column for Test group #1--612--equals the total clicks for Test group #1 in Table 2.

The sum of all of the registrations for the subgroups in test group one and two are higher than the registrations reported in the test group comparison table. This is also true with the sum of the clicks and purchases for both test groups. This is because some users will change segments during the campaign. If a user purchases after seeing advertising messages from multiple segments, multiple treatments will be given credit. Impressions, clicks, purchases, and registrations are counted using this same algorithm.

“Group impressions” and “group clicks” are included only for informational purchases. The sum of these columns will add up to the test group totals, since they only include the impressions and clicks from users while in that segment.

The metrics produced in this manner by the facility are unbiased. They measure cumulative advertising message effect without relying on arbitrary algorithms to give credit for an action to one advertising message. In addition, they are low-variance because only impressions that may have contributed to these events are included, enabling the facility to ignore data that is merely adding noise.

While embodiments of the facility described above select advertising messages that are provided via the World Wide Web to users of general-purpose computer systems executing Web browsers, additional embodiments of the facility may be used with other communication channels and/or other types of devices. In particular, the facility may preferably be used in connection with advertising messages delivered to such special-purpose devices as personal digital assistants, cellular and satellite phones, pagers, devices installed in automobiles and other vehicles, automatic teller machines, televisions, and other home appliances.

It will be understood by those skilled in the art that the above-described facility could be adapted or extended in various ways. For example, the facility may utilize target targeting programs that are organized differently, and those that incorporate more levels of logic, or logic of various different types. The results of the targeting performed by the facility may be analyzed in a variety of ways other than those described above. While the foregoing description makes reference to preferred embodiments, the scope of the invention is defined solely by the claims that follow and the elements recited therein.